

## CLAIMS:

1. A precision soft-touch gripping mechanism for flat objects having a peripheral edge, said mechanism comprising:
  - a flat gripper body having an upper surface, a lower surface and attachable to an external manipulation means;
  - at least one longitudinal gripping finger in the form of an elongated member having a distal end and a proximal end, said distal end supporting at least one distal gripping post;
  - a first side gripping finger comprising a lever of the second order pivotally installed on said gripper body and having a first arm and a second arm, said first arm supporting at least one second side gripping post, and said second arm having a first guide slot;
  - a second side gripping finger comprising a lever of the second order pivotally installed on said gripper body and having a third arm and a fourth arm, said third arm supporting at least one third side gripping post, and said second arm having a second guide slot;
  - a pin that is rigidly attached to said proximal end of said at least one longitudinal gripping finger and is guided in said first guide slot and in said second guide slot simultaneously;
  - a moveable frame that rigidly supports said pin and is moveable in the direction of said at least one longitudinal gripping finger, said frame having a first end face nearest to said pin and a second end face opposite to said first end face;
  - linear drive means having an output shaft that supports pushing member;
  - a flexible member between said pushing member and said second end face of said frame; and
  - gripping force control means common for said at least one longitudinal gripping finger, said first side gripping finger, and said

second side gripping finger for controlling a final soft-touch gripping force applied from said at least one distal gripping post, said second side gripping post, and said third side gripping force to said periphery edges of said flat objects via said flexible member.

2. The precision soft-touch gripping mechanism of Claim 1, further provided with rotary drive means for rotating said at least one longitudinal gripping finger with said at least one distal gripping post by an angle less than  $90^\circ$  between a position, in which the configuration of said at least one longitudinal gripping finger is in flush with said gripper body and substantially do not project beyond the boundaries of said upper surface and said lower surface of said gripper body and a position in which said at least one longitudinal gripping finger projects above said upper surface.

3. The precision soft-touch gripping mechanism of Claim 1, wherein said angle less than  $90^\circ$  is selected from  $60^\circ$ ,  $65^\circ$ ,  $70^\circ$ ,  $75^\circ$ ,  $80^\circ$ ,  $85^\circ$ , and  $88^\circ$ .

4. The precision soft-touch gripping mechanism of Claim 1, gripping force control means comprises: controller means and a position sensor, said position sensor comprising flag means attached to said pushing member and a measurement means attached to said moveable frame and sensitive to a position of said flag means, said measurement means and said linear drive means being electrically connected to said controller means.

5. The precision soft-touch gripping mechanism of Claim 1, wherein said flag means is a magnetic member and said measurement means is a Hall sensor chip that responds to the position of said magnetic flag and generates a voltage signal which is sent to said controller means and which is proportional to said position of said magnetic flag, said controller means being set to a preset value

of said voltage signal corresponding to said final soft-touch gripping force and sends a signal for stopping said linear drive means when said voltage signal becomes equal to said preset value.

6. The precision soft-touch gripping mechanism of Claim 5, wherein said flag means is a magnetic member and said measurement means is a Hall sensor chip that responds to the position of said magnetic flag and generates a voltage signal which is sent to said controller means and which is proportional to said position of said magnetic flag, said controller means being set to a preset value of said voltage signal corresponding to said final soft-touch gripping force and sends a signal for stopping said linear drive means when said voltage signal becomes equal to said preset value.

7. The precision soft-touch gripping mechanism of Claim 1, wherein said flexible member is a helical spring.

8. The precision soft-touch gripping mechanism of Claim 3, wherein said flexible member is a helical spring.

9. The precision soft-touch gripping mechanism of Claim 6, wherein said flexible member is a helical spring.

10. The precision soft-touch gripping mechanism of Claim 5, wherein said flexible member is a helical spring.

11. The precision soft-touch gripping mechanism of Claim 2, wherein said rotary drive means comprises a rotary drive motor with a driving member and driven member engaged with said driving member and fitted onto said longitudinal gripping finger with means for rotation together with said driven member and with possibility of relative movement between said longitudinal gripping finger and

said driven means in said direction of said at least one longitudinal gripping finger.

12. The precision soft-touch gripping mechanism of Claim 8, wherein said rotary drive means comprises a rotary drive motor with a driving member and driven member engaged with said driving member and fitted onto said longitudinal gripping finger with means for rotation together with said driven member and with possibility of relative movement between said longitudinal gripping finger and said driven means in said direction of said at least one longitudinal gripping finger.

13. The precision soft-touch gripping mechanism of Claim 9, wherein said rotary drive means comprises a rotary drive motor with a driving member and driven member engaged with said driving member and fitted onto said longitudinal gripping finger with means for rotation together with said driven member and with possibility of relative movement between said at least one longitudinal gripping finger and said driven means in said direction of said at least one longitudinal gripping finger.

14. The precision soft-touch gripping mechanism of Claim 2, further comprising an additional longitudinal gripping finger arranged parallel to said at least one longitudinal gripping finger and supporting a second distal gripping post, said driven member being engaged with a second driven member which is fitted on said additional longitudinal gripping finger with possibility of relative movement between said additional longitudinal gripping finger and said second driven member in said direction of said additional longitudinal gripping finger, said first side gripping finger having a first additional side gripping post located near said at least one second side gripping post, and said second side gripping finger having a second additional side gripping post located near said at least one third side gripping post.

15. The precision soft-touch gripping mechanism of Claim 8, further comprising an additional longitudinal gripping finger arranged parallel to said at least one longitudinal gripping finger and supporting a second distal gripping post, said driven member being engaged with a second driven member which is fitted on said additional longitudinal gripping finger with possibility of relative movement between said additional longitudinal gripping finger and said second driven member in said direction of said additional longitudinal gripping finger, said first side gripping finger having a first additional side gripping post located near said at least one second side gripping post, and said second side gripping finger having a second additional side gripping post located near said at least one third side gripping post.

16. The precision soft-touch gripping mechanism of Claim 9, further comprising an additional longitudinal gripping finger arranged parallel to said at least one longitudinal gripping finger and supporting a second distal gripping post, said driven member being engaged with a second driven member which is fitted on said additional longitudinal gripping finger with possibility of relative movement between said additional longitudinal gripping finger and said second driven member in said direction of said additional longitudinal gripping finger, said first side gripping finger having a first additional side gripping post located near said at least one second side gripping post, and said second side gripping finger having a second additional side gripping post located near said at least one third side gripping post.

17. The precision soft-touch gripping mechanism of Claim 1, further provided with a stopper attached to said moveable frame and supporting a switching member electrically connected to said gripping force control means for controlling operation of said linear drive means, said switching means being capable of engaging said pushing member during movement of said pushing member.

18. The precision soft-touch gripping mechanism of Claim 17, further provided with means for adjusting position of said stopper with respect to said moveable frame.

19. The precision soft-touch gripping mechanism of Claim 2, further provided with a stopper attached to said moveable frame and supporting a switching member electrically connected to said gripping force control means for controlling operation of said linear drive means, said switching means being capable of engaging said pushing member during movement of said pushing member.

20. The precision soft-touch gripping mechanism of Claim 19, further provided with means for adjusting position of said stopper with respect to said moveable frame.

21. The precision soft-touch gripping mechanism of Claim 6, further provided with a stopper attached to said moveable frame and supporting a switching member electrically connected to said gripping force control means for controlling operation of said linear drive means, said switching means being capable of engaging said pushing member during movement of said pushing member.

22. The precision soft-touch gripping mechanism of Claim 21, further provided with means for adjusting position of said stopper with respect to said moveable frame.

23. The precision soft-touch gripping mechanism of Claim 14, further provided with a stopper attached to said moveable frame and supporting a switching member electrically connected to said gripping force control means for controlling operation of said linear drive means, said switching means being capable of engaging said pushing member during movement of said pushing member.

24. The precision soft-touch gripping mechanism of Claim 23, further provided with means for adjusting position of said stopper with respect to said moveable frame.